



# Monitoring Energy and Carbon Performance in New Homes

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# Energy Saving Trust principles

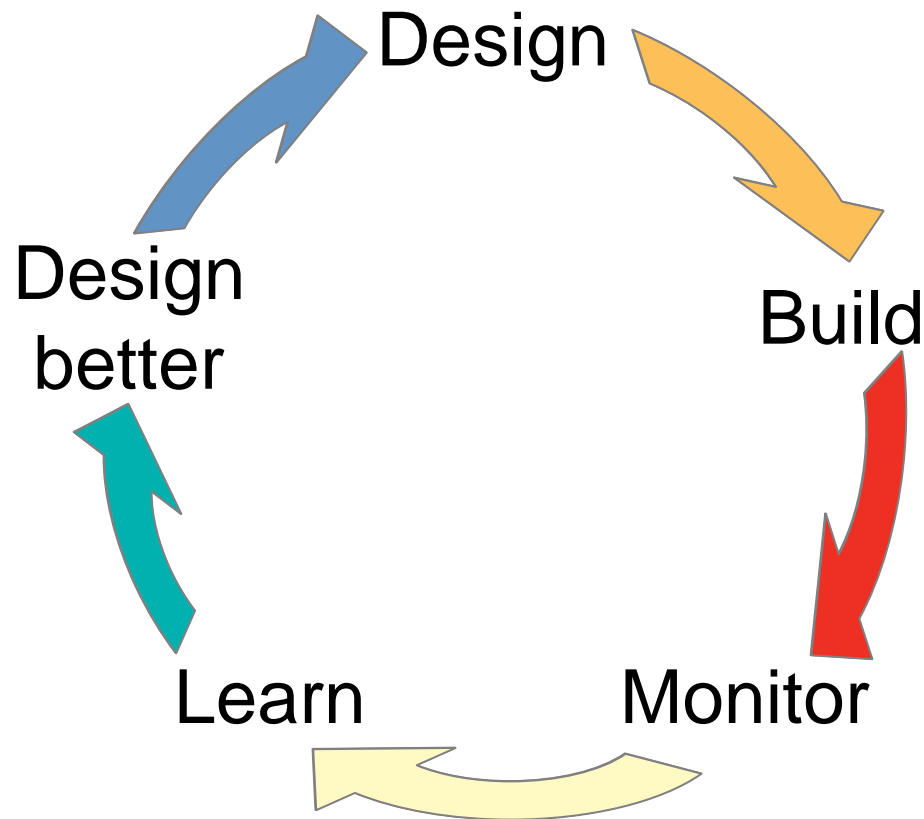
- Energy efficiency needs to go in first
  - Not a short term fix of bolt-on measures
- Incremental steps
- Working together – learn from mistakes
- Energy Saving Trust guidance
  - Guidance is for compliance with the energy elements of the Code
  - Publishing will improve clarity on approach to risk and uncertainty



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# The way forward



# What is needed for success?

- Long-term target
- Interim targets
- Incentives
- Accreditation / recognition
- Research & monitoring
- Training
- Planning policy
- Enforcement
- Consumer engagement

# Long-term target

- Net carbon emissions resulting from all energy used in the dwelling is zero
- Approximately 149% reduction in emissions from 2006 Building Regulations
- On or offsite additional new renewables capacity
- Heat loss parameter of 0.8 W/m<sup>2</sup>K or less is required
  - Requires a highly insulated building fabric, combined with excellent dwelling airtightness and, depending on available solar gains, the avoidance of high glazing to floor area ratios
- Capacity equivalent to a specific kWh/m<sup>2</sup> of floor area
- 240,000 homes built per annum

... by 2016

# Why do we need to monitor?

- What is actual performance
- What works, what doesn't
- Ensuring confidence in new products
- Securing investment in new products
- Liveability vs. attractiveness
- Consumer pull vs. regulatory push

# What we intend to do

- To measure the energy consumption and hence carbon emissions of sample houses built to the new designs
- To examine how this measured performance compares with that of a control group of houses
- To determine how the key features of the new designs (enhanced airtightness, improved fabric insulation levels, renewable sources of energy) contribute to the improved energy performance of the new designs

# Why we must do it

- Previously difficult to make comparisons between different projects
  - A great deal of potential information has thus been lost
- There is no plan for a scientific approach
  - SAP itself has not been validated through comprehensive, in-house energy monitoring for two decades
  - No central plans for the monitoring of the new designs and specific features of the low-carbon homes we are about to build
- A standardised approach to monitoring, but also on a standardised format for reporting results

# Data collection methods

- The simplest approach to determining annual energy consumption, and hence carbon emissions, is to take readings from energy meters at the start and finish of the monitoring year
  - This is not robust!
- Manual readings of meters and temperature indicators
- Automatic recording using data loggers
  - Direct
  - Remote

# Short term measures

- Often referred to as ‘one-time tests’
  - In practice it may be desirable to repeat these tests several times after a building has been occupied for a period and allowed to ‘settle in’
  - Provide a snapshot measure of one aspect of building performance, irrespective of climate or occupant behaviour
- Envelope airtightness
- Mechanical ventilation system operation
- Fabric insulation performance

# Long term measures

<i>Technology</i>	<i>Performance indicator(s)</i>	<i>Key drivers</i>	<i>Measurements required</i>
Dwelling fabric	Building gas consumption Building electricity consumption Building water consumption	Internal temperature External temperature	Heating energy consumption (gas, electricity, oil, bio-fuel, etc) Electricity consumption Water consumption Internal temperature External temperature
Solar water heating	Contribution to water heating requirement Parasitic electricity consumption	Array plane solar radiation	System heat output System electricity consumption Array plane solar
Photovoltaics	System electrical energy output	Array plane solar radiation	System electrical output Dwelling electricity import Array plane solar
Wind turbine	System electrical energy output	Wind speed and direction	System electrical output Dwelling electricity import Local wind speed and direction
Heat pump	Contribution to heating requirements	Electrical input Ground or appropriate air temperature	System heat output System electricity consumption Ground or appropriate air temperature

Where dwellings feature different technologies (e.g. solar water heating and PV), it may be possible to share sensors between technologies, giving cost reductions

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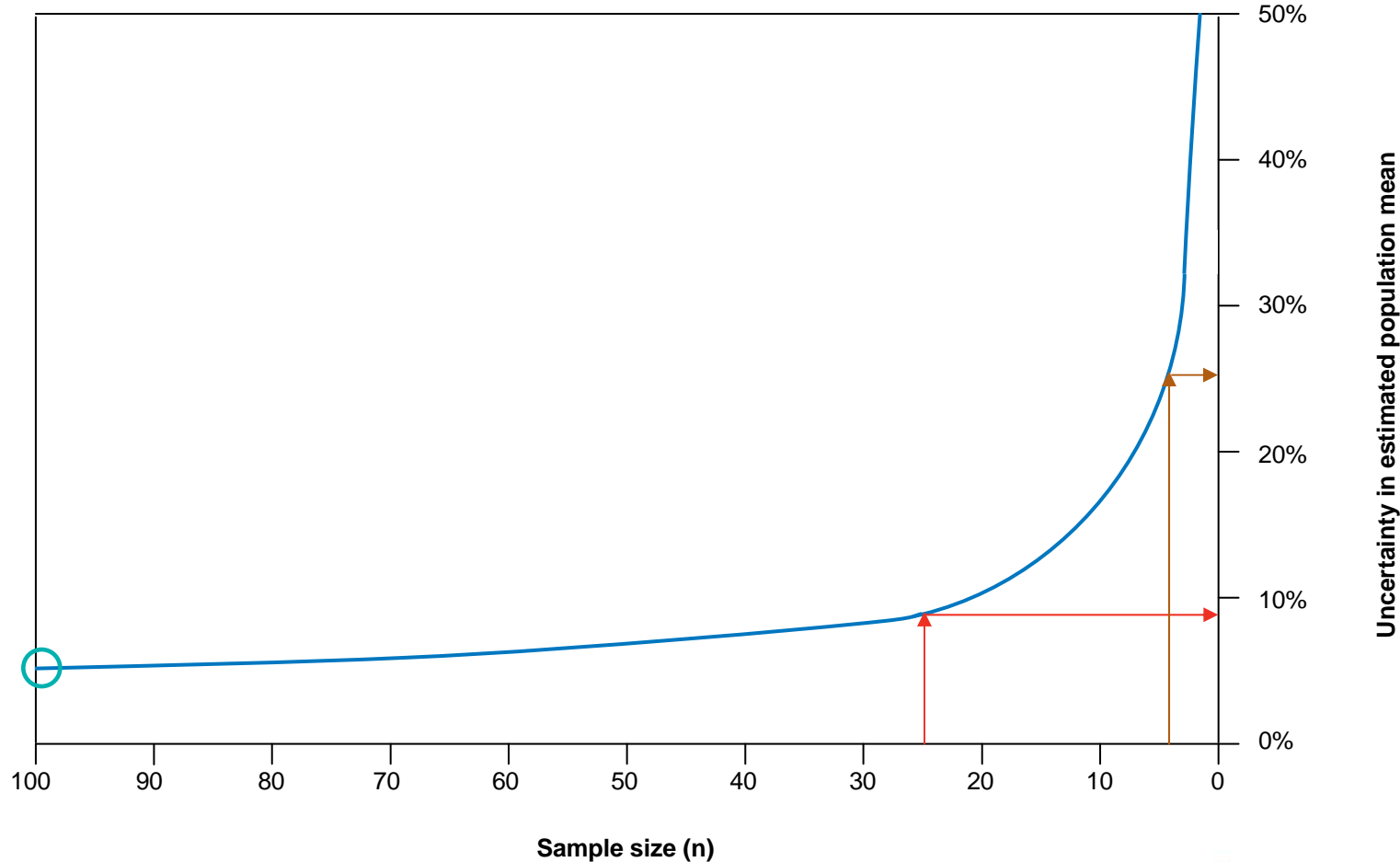
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# Requirements placed on developers

- Requirements for the short term tests are:
  - Making completed dwelling available for one day tests of airtightness
  - Making completed dwelling available for tests on mechanical ventilation and heat recovery system
  - Making completed dwelling available for co-heating tests of building fabric
- Requirements for the long term testing are:
  - Liaison with utility companies to ensure that gas, electricity and water meters have pulsed outputs suitable for connection to the data acquisition system
  - Provision of an external, lockable, cabinet to house the data acquisition system for direct collection routes
  - Provision of a mains power supply to the data acquisition system
  - Provision of low voltage cabling to the data acquisition system at the electrical first fix stage

# Sampling rates



# Mid Street – Code 5

- First Code 5 homes built to be lived in
- We will monitor the development for 2 years
  - ACIS have supplied the data collection infrastructure
- Long term measures will remotely monitor
  - Heating
  - Water consumption
  - Electricity



# Future plans for whole house monitoring

- The energy monitoring protocol needs in practice to be accompanied by a number of other protocols, namely:
  - Householder engagement protocol – how to convince the householder to participate?
  - Behaviour protocol – how do the householders behave within their homes?
  - Liveability protocol – what is the home like to live in?

# Energy monitoring projects

- The Energy Saving Trust has experience developing and managing numerous monitoring projects of energy efficiency installations in domestic households
  - CWI; insulation; ventilation rates; condensing boilers; lighting; domestic hot water
- Projects are undertaken to determine the following information:
  - If efficiency measures affect user behaviour
  - If actual energy/carbon savings are similar to anticipated
- The key objective of all Energy Saving Trust monitoring work is to inform
  - Industry
  - Consumer

# Current and planned projects

- Current field trials include:
  - Condensing boiler field trials
  - Micro-wind field trials
  - Heat pump field trials
- Plans for further field trials of microgeneration technologies with funding and support from industry stakeholders:
  - Solar PV; solar thermal; combinations of microgeneration technologies
- Funding won for field trials through the Environmental Transformation Fund:
  - LED lighting; advanced heating controls; solid wall insulation

# Consumer attitudes online survey

- Even for new-build homes energy efficiency isn't considered
- Consumers feel that positive behaviour towards the environment should be rewarded and they should not have to pay more for low carbon homes
- Potential homeowners care about the environment but seek results before committing money to technology & homes
- However, when asked in isolation and away from other influencing factors, new-build property buyers are keen to consider the environmental impact of their property



# Consumer attitudes

*"I would like to own a [low carbon] property for its impact in reducing my carbon footprint as I feel we should all work towards protecting the environment. I do however feel that government should, through tax breaks, subsidise eco-friendly building and that the consumer should not have to pay more"*

*"If building regs aren't good enough then they should be raising the standards."*

*"The technology is too new - I would prefer to see it tried and tested before I put my hard-earned money into it"*

*"This might put me off a house, 'cause they will want more money for it to try and recover the costs of all the work."*

*"We bought a new build because we didn't want to have to do anything to it"*

*"I feel we should all work towards protecting the environment. I do feel that government should, through tax breaks, subsidise eco-friendly building and the consumer should not have to pay more"*

*"Ethically, I care about the long term impact on the environment and would like to do my bit to help, if the extra cost is partially offset by lower bills then that's even better"*

*"You fall in love with the house, you don't think about what type of boiler it's got."*

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# Energy Saving Trust offers

- Technical advice, guidance and support
  - 90+ publications freely available as download or hardcopy
  - Website and online tools
  - Education, training and events
  - Helpline
  - Research and case studies



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